

Investigating the Response and Expansion of Plasma Plumes in a Mesosonic Plasma using the Situational Awareness Sensor Suite for the ISS (SASSI)

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To study the complex interactions between the space environment surrounding the International Space Station (ISS) and the ISS space vehicle, we are exploring a specialized suite of plasma sensors, manipulated by the Space Station Remote Manipulator System (SSRMS) to probe the near-ISS mesosonic plasma ionosphere moving past the ISS. It is proposed that SASSI consists of the NASA Marshall Space Flight Center's (MSFC's) Thermal Ion Capped Hemispherical Spectrometer (TICHS), Thermal Electron Capped Hemispherical Spectrometer (TECHS), Charge Analyzer Responsive to Local Oscillations (CARLO), the Collimated PhotoElectron Gun (CPEG), and the University of Michigan Advanced Langmuir Probe (ALP). There are multiple expected applications for SASSI. Here, we will discuss the study of fundamental plasma physics questions associated with how an emitted plasma plume (such as from the ISS Plasma Contactor Unit (PCU)) responds and expands in a mesosonic magnetoplasma as well as emit and collect current. The ISS PCU Xe plasma plume drifts through the ionosphere and across the Earth's magnetic field, resulting in complex dynamics. This is of practical and theoretical interest pertaining to contamination concerns (e.g. energetic ion scattering) and the ability to collect and emit current between the spacecraft and the ambient plasma ionosphere. This impacts, for example, predictions of electrodynamic tether current performance using plasma contactors as well as decisions about placing high-energy electric propulsion thrusters on ISS. We will discuss the required measurements and connection to proposed instruments for this study.